Fig. 1

Type of Lead-Acid Battery Plate Paste Mix	Lead Oxide	Micronized TTBLS Additive	Water	Sulfuric Acid	Flock	Expander
Automotive Positive Plate Paste	1071kg (79.52%weight)	10.71kg (0.79%weight)	140kg (10.39%weight)	125kg (9.28%weight)	0.5kg (0.02%weight)	0 0
Automotive Battery Negative Paste	1071kg (78.30%weight)	10.71kg (0.79%weight)	140kg (10.23%weight)	135kg (9.86%weight)	0.5kg (0.03%weight)	10.71kg (0.79%weight)
Industrial Positive Plate Paste	1071kg (80.09%weight)	10.71kg (0.80%weight)	135kg (10.09%weight)	120kg (8.98%weight)	0.5kg (0.04%weight)	0 0
Industrial Battery Negative Paste	1071kg (79.41%weight)	10.71kg (0.79%weight)	130kg (9.64%weight)	115kg (8.53%weight)	0.5kg (0.04%weight)	21.4kg (1.59%weight)

Fig. 2

-1st Sample

Effect of 1% TTBLS on Industrial Paste and Plate Curing

Control Samples					
Sample	Trial	α-PbO (Tetra)	β-PbO (Ortho)	Tetrabasic	Tribasic
Paste at end of mixing	-1	58.0	2.6	0.0	39.4
	-2	51.1	7.9	0.0	40.9
	-3	59.4	2.2	1.2	37.2
	-4	66.4	2.1	0.0	31.5
	5	50.2	1.1	2.4	46.3
	AVG	57.0	3.2	0.7	39.1
Pasted plate at end of tunnel dryer	1	66.7	1.9	0.0	31.4
	-2	59.2	8.5	5.7	26.6
	-3	55.9	5.5	10.6	28.1
	-4	61.8	4.8	2.1	31.3
	-5	60.8	3.2	6.9	29.1
	AVG	60.9	4.8	5.1	29.3
Plates after 3 hours curing	-1	57.5	9.7	0.5	32.3
	-2	61.2	10.7	0.0	28.8
	-3	60.7	8.7	2.1	28.5
	-4	60.4	9.8	1.0	28.7
	-5	58.7	5.3	2.9	33.1
	AVG	59.7	8.8	1.3	30.3
Plates after 6 hours curing	1	52.0	4.4	1.8	41.8
	2	57.1	9.1	0.0	33.7
	-3	59.6	2.4	0.9	37.1
	-4	54.4	8.2	1.6	35.8
	-5	57.2	7.5	2.7	32.6
	AVG	56.1	6.3	1.4	36.2
Plates after 9 hours curing	1	52.6	4.3	1.5	41.6
	-2	67.7	2.3	1.9	28.2
	-3	63.6	6.9	1.9	27.6
	-4	60.2	10.4	2.3	27.2
	-5	61.6	3.2	1.9	33.3
	AVG	61.1	5.4	1.9	31.6
Plates after 12/13 hours curing	-1	30.2	1.7	68.1	0.0
	-2	59.1	10.3	4.6	26.0
	-3	59.8	2.1	14.2	23.9
	-4	64.9	2.3	11.0	21.8
	-5	53.9	4.3	9.3	32.4
	AVG	53.6	4.8	21.4	26.0

Experimental Samples					
Sample	Trial	α-PbO (Tetra)	β-PbO (Ortho)	Tetrabasic	Tribasic
Paste at end of mixing	-1	38.5	0.0	51.7	9.8
	-2	34.1	0.7	57.7	7.5
	-3	36.1	0.0	58.3	5.5
	-4	40.2	0.0	55.1	4.7
	-5	34.5	1.2	59.5	4.8
	AVG	36.7	0.4	56.5	6.5
Pasted plate at end of tunnel dryer	-1	81.9	8.1	10.1	0.0
	-2	45.2	2.1	27.4	25.3
	-3	44.1	1.6	29.9	23.9
	-4	43.8	1.2	43.0	11.9
	-5	48.6	3.4	19.5	28.5
	AVG	52.7	3.3	26.0	17.9
Plates after 3 hours curing	-1	26.2	2.2	71.6	0.0
	-2	20.8	4.3	71.5	3.4
	-3	34.6	3.4	57.4	4.6
	-4	24.1	3.4	66.7	5.8
	5	36.9	1.9	51.3	10.0
	AVG	28.5	3.0	63.7	4.8
Plates after 6 hours curing	-1	25.3	2.9	71.8	0.0
	-2	19.4	5.5	72.6	2.5
	-3	31.0	2.0	67.0	0.0
	-4	28.1	1.4	66.8	3.6
	-5	32.6	1.7	65.6	0.0
	AVG	27.3	2.7	68.8	1.2
Plates after 9 hours curing	-1	26.7	4.5	61.7	7.0
	-2	27.3	1.5	67.9	3.4
	3	31.0	1.8	67.2	0.0
	-4	30.2	0.8	69.0	0.0
	-5	29.0	1.6	65.8	3.5
	AVG	28.8	2.0	66.3	2.8
Plates after 12/13 hours curing	-1	29.5	1.0	69.5	0.0
	-2	18.9	2.5	75.3	3.3
	-3	32.5	1.5	65.9	0.0
	-4	28.8	0.7	67.1	3.3
	-5	30.9	1.0	68.1	0.0
	AVG	28.1	1.3	69.2	1.3

Fig. 3

2nd Sample

Effect of 1% TTBLS on Industrial Paste and Plate Curing

Control Samples						
Sample	Sample No.	Pb	α-PbO (Tetra)	β-PbO (Ortho)	Tetrabasic	Tribasic
Paste at end of mixing		13.8	25.8	5.1	5.1	50.3
	AVG	13.8	25.8	5.1	5.1	50.3
Pasted plate at end of tunnel		15.6	28.2	2.4	10.6	43.3
	AVG	15.6	28.2	2.4	10.6	43.3
Full rack in chamber		16.5	28.5	13.8	0.0	41.2
	AVG	16.5	28.5	13.8	0.0	41.2
After 2 hours in chamber		17.1	27.7	8.0	2.8	44.4
	AVG	17.1	27.7	8.0	2.8	44.4
After 4 hours in chamber		14.6	22.6	3.1	16.2	43.5
	AVG	14.6	22.6	3.1	16.2	43.5
After 6.5 hours in chamber		17.2	24.8	2.4	14.9	40.7
	AVG	17.2	24.8	2.4	14.9	40.7
After 8.6 hours in chamber		18.6	19.8	16.1	3.3	42.2
	AVG	18.6	19.8	16.1	3.3	42.2
After 12.5 hrs in chamber		12.0	17.5	4	29	37.4
	AVG	12	17.5	4	29	37.4
After 18.5 hours in chamber		3.2	14.5	1.1	59.6	21.6
	AVG	3.2	14.5	1.1	59.6	21.6
After 20.5 hours in chamber		4.7 0	25 15	14.65 1.1	43.5 75.3	25.1 8.6
	AVG	2.35	20	7.975	59.4	16.85
After 24.5 hours in chamber		0	15	1.1	75.3	8.6
	AVG	0	15	1.1	75.3	8.6
After 28.5 hours in chamber		0	15.4	1.3	76.8	6.6
	AVG	0	15.4	1.3	76.8	6.6

Experimental Samples						
Sample	Sample No.	Pb	α-PbO (Tetra)	β-PbO (Ortho)	Tetrabasic	Tribasic
Paste at end of mixing		11.4 17.8 18.7	10.9 6.7 6.3	2.7 0.8 0.0	53.2 69.1 50.0	21.9 5.6 25.0
	AVG	15.97	8.0	1.2	57.4	17.5
Pasted plate at end of tunnel		8.2 16.6 19.8	13.0 8.6 4.7	3.2 0.9 0.0	54.7 57.3 67.4	20.9 16.6 8.1
	AVG	14.87	8.8	1.4	59.8	15.2
Full rack in chamber		8.2 18.4 18.3	13.5 6.0 9.2	0.9 0.4 0.8	62.3 56.1 66.2	15.2 19.1 5.5
	AVG	14.97	9.6	0.7	61.5	13.3
After 2 hours in chamber		9 12.6 19.2	12.8 5.7 5.8	1.1 2.7 1.3	77.1 70.8 64.7	0.0 8.5 9.0
	AVG	13.60	8.1	1.7	70.8	5.8
After 4 hours in chamber		7.3 12.2 6.5	6.9 4.4 9.6	1.0 1.4 1.0	73.0 68.2 75.5	11.8 13.9 7.4
	AVG	8.67	7.0	1.1	72.2	11.0
After 6 hours in chamber		7.6 11.9 7.3	10.5 2.7 3.9	1.1 1.4 2.0	80.2 70.0 74.1	0.3 14.0 12.7
	AVG	9	5.7	1.5	74.8	9.0
After 8 hours in chamber		6.4 9.4	5.2 7.9	1.6 1.8	73 72.4	13.8 8.7
	AVG	7.9	6.55	1.6	72.7	11.25
After 10 hours in chamber		2.4	5.9	2.2	80	9.5
	AVG	2.4	5.9	2.2	80	9.5
After 12 hours in chamber		1.9 1.7	3.4 10.5	2.4 1.7	83.7 80.3	8.5 5.8
	AVG	1.8	6.95	2.05	82	7.15
After 14 hours in chamber		7.4	8.4	1.2	72.4	10.6
	AVG	7.4	8.4	1.2	72.4	10.6
After 16 hours in chamber		1.2 13.1	5.6 8.4	2 1.3	83.4 72.4	7.7 4.8
	AVG	7.15	7.00	1.65	77.90	6.25
After 18 hours in chamber		1.3 0	4.4 7.2	3.3 0	83.7 86.5	7.3 6.4
	AVG	0.65	5.8	1.65	85.1	6.85
After 20 hours in chamber		1.7 0.8	6.9 10.8	2.3 1.9	81.1 86.5	7.9 0
	AVG	1.05	7.83	1.95	84.23	4.92
After 22 hours in chamber		1.3	4.4	3.3	83.7	7.3
	AVG	1.3	4.4	3.3	83.7	7.3
After 24 hours in chamber		1.5 1.3	11.8 8.7	2.3 2.4	84.5 80.3	0 7.3
	AVG	1.4	10.25	2.35	82.4	3.65
After 26 hours in chamber		0.7	6.4	2.1	89.7	1.1
	AVG	0.7	6.4	2.1	89.7	1.1
After 28 hours in chamber		0.6 1.1	11.5 6	1.9 2.4	86 89.2	0 1.4
	AVG	0.85	8.75	2.15	87.6	0.7

Fig. 4

1st Sample

Effect of 1% Micronized TTBLS on Industrial Paste and Plate Curing

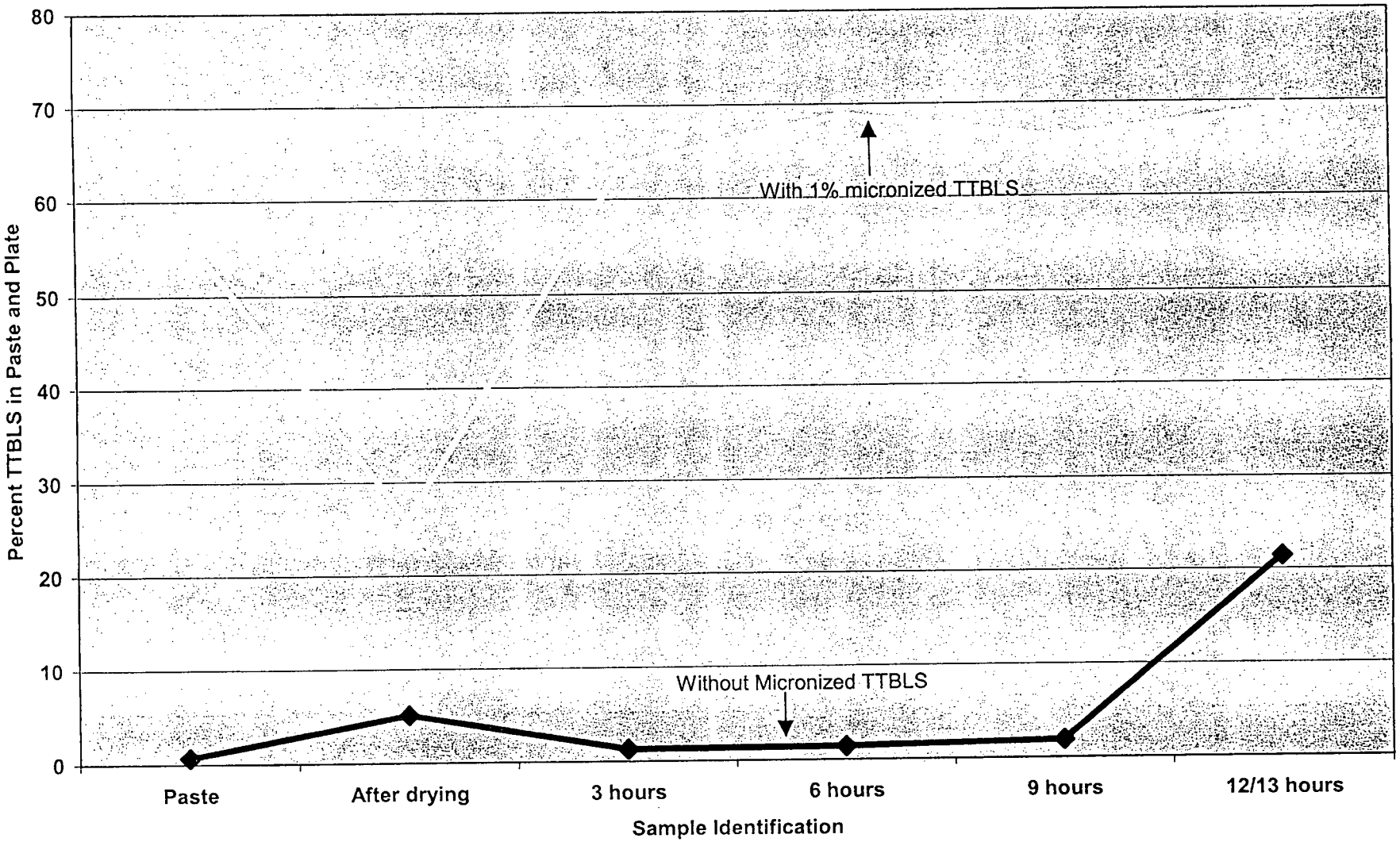


Fig. 5

2nd sample

Effect of 1% Micronized TTBLS on Industrial Paste and Plate Curing

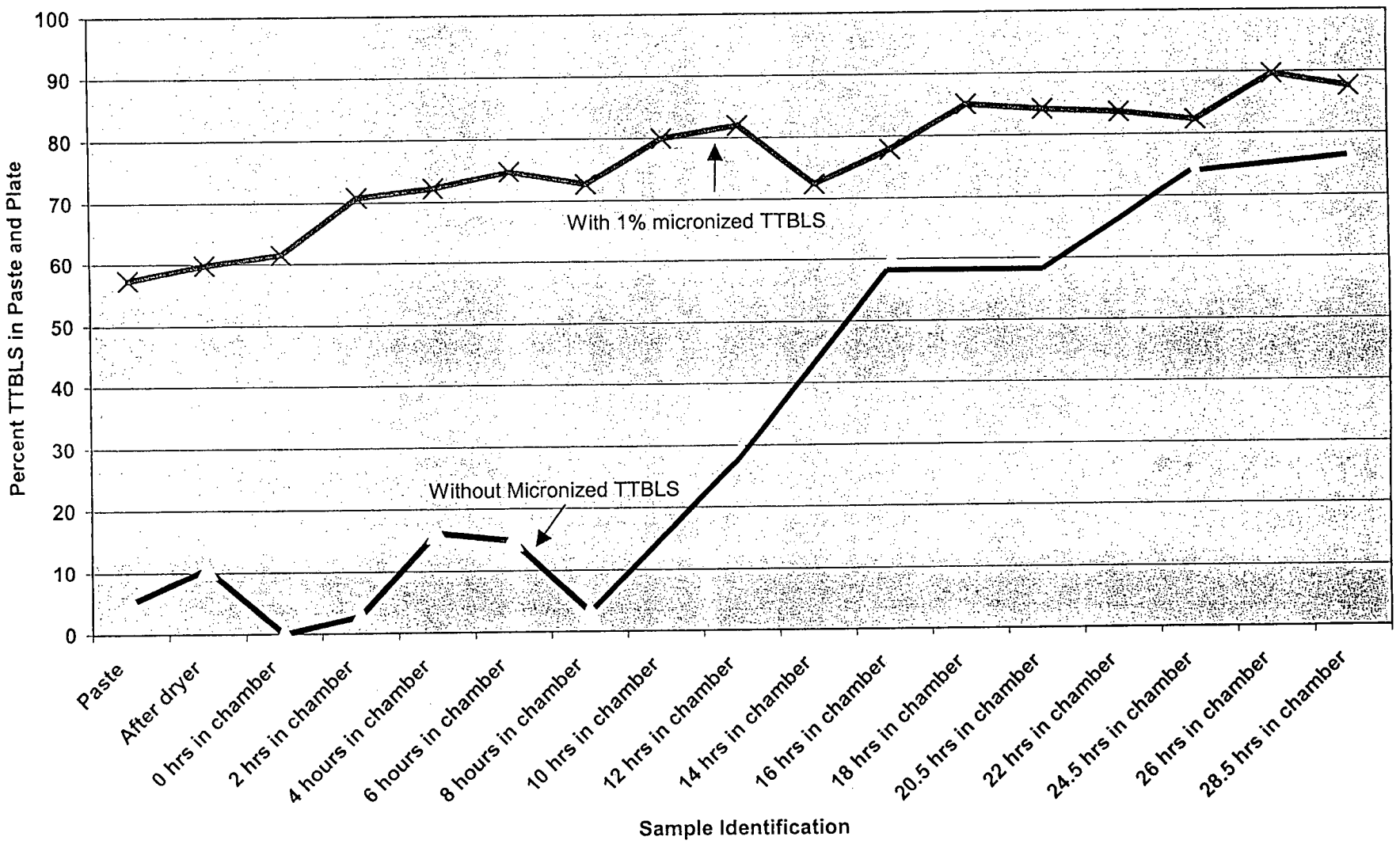


Fig. 6

Effect of 1% TTBLS on Automotive Paste and Plate Curing - Third Sample

Control Samples						
Sample	Trial	Pb	α-PbO (Tetra)	β-PbO (Ortho)	Tetra	Tri
Paste at end of mixing	41	9.3	62.3	0.0	0.0	26.6
	40	3.1	72.5	1.4	0.0	23.1
	AVG	6.2	67.4	0.7	0.0	24.9
Pasted plate at end of tunnel dryer	37	5.4	60.4	0.0	0.0	34.2
	38	18.7	49.3	0.7	0.0	31.3
	39	10.8	58.3	0.5	0.0	30.4
	AVG	11.63	56.0	0.4	0.0	32.0
Two hours after loading curing chamber						
	AVG					
Six hours after loading curing chamber	-1		52.0	4.4	1.8	41.8
	-2		57.1	9.1	0.0	33.7
	-3		59.6	2.4	0.9	37.1
	-4		54.4	8.2	1.6	35.8
	-5		57.2	7.5	2.7	32.6
	AVG		56.1	6.3	1.4	36.2
8 hours after loading curing chamber	12	7	63.1	1.0	0.0	28.8
	17	8.3	60.5	5.5	0.0	26.1
	18	6.8	59.1	5.1	0.0	28.9
	-4		60.2	10.4	2.3	27.2
	-5		61.6	3.2	1.9	33.3
	AVG	7.4	60.9	5.0	0.8	28.9
18 hours after loading curing chamber	21	8.1	57.9	2.8	7.3	24.0
	23	7.5	58.2	3.6	7.9	24.0
	24	7.7	67.7	0.0	0.0	24.6
	AVG	7.8	63.0	1.8	4.0	24.3
24 hours after loading chamber	29	5.1	44.4	0	35.7	14.8
	30	2.5	62.6	1	12.1	21.8
	AVG	3.8	53.5	0.5	23.9	18.3
End of cure	31	0	53.2	0.3	31.9	14.7
	32	0.8	50.7	0	36.2	12.3
	AVG	0.4	51.95	0.15	34.05	13.5

Experimental Samples						
Sample	Trial	Pb	α-PbO (Tetra)	β-PbO (Ortho)	Tetra	Tri
Paste at end of mixing	1	6.7	51.0	0.0	19.8	23.1
	2	14.9	48.3	0.9	12.2	23.7
	AVG	10.8	49.7	0.5	16.0	23.4
Pasted plate at end of tunnel dryer	3	10.3	49.3	0.5	14.3	25.8
	4	8	47.7	4.1	15.9	24.3
	5	17.2	43.0	0.6	14.3	24.9
	42	13.8		1.2	21.4	22.1
	AVG	12.3	46.7	1.6	16.5	24.3
Two hours after loading curing chamber	6	12.9	43.3	0.6	21.8	21.3
	7	14.1	44.3	4.8	17.8	19.1
	8	12.3	49.2	1.4	18.4	18.8
	9	10.2	45.3	0.4	24.1	20.1
	IS					
	AVG	12.4	45.5	1.8	20.5	19.8
Six hours after loading curing chamber	10	4.4	25.2	4.4	60.7	5.3
	AVG	4.4	25.2	4.4	60.7	5.3
8 hours after loading curing chamber	11	6.5	21.6	1.0	66.3	4.5
	13	1.9	26.8	1.8	64.3	5.2
	14	4	29.0	2.5	56.9	7.6
	15	0	29.6	1.9	62.6	5.8
	16	3.9	24.8	1.9	63.7	5.7
	AVG	4.1	26.4	1.8	62.8	5.8
18 hours after loading curing chamber	19	5.6	21.9	2.8	66.1	3.7
	20	5.3	22.3	3.4	64.3	4.3
	22	6.1	24.8	0.9	64.7	3.4
		3.7	25.1	2.3	68.9	0.0
	AVG	5.7	23.53	2.35	66.0	2.9
24 hours after loading curing chamber	25	1.3	24.5	0.8	69.9	3.5
	26	1.5	25.5	0	69.3	3.6
	27	2.6	28	1.1	61.8	6.5
	28	2.9	25.8	0	67.4	3.8
	AVG	2.075	25.95	0.475	67.1	4.35
End of cure	33	0	27.3	2.5	67.2	3
	34	3	28.4	1.3	64	3.2
	35	0.6	27.6	0	68.6	3.2
	36	0.6	26	3.1	64	6.2
	AVG	1.05	27.325	1.725	65.95	3.9

Fig 7

Third sample

Effect of 1% Micronized TTBLS on Automotive Paste and Plate Curing

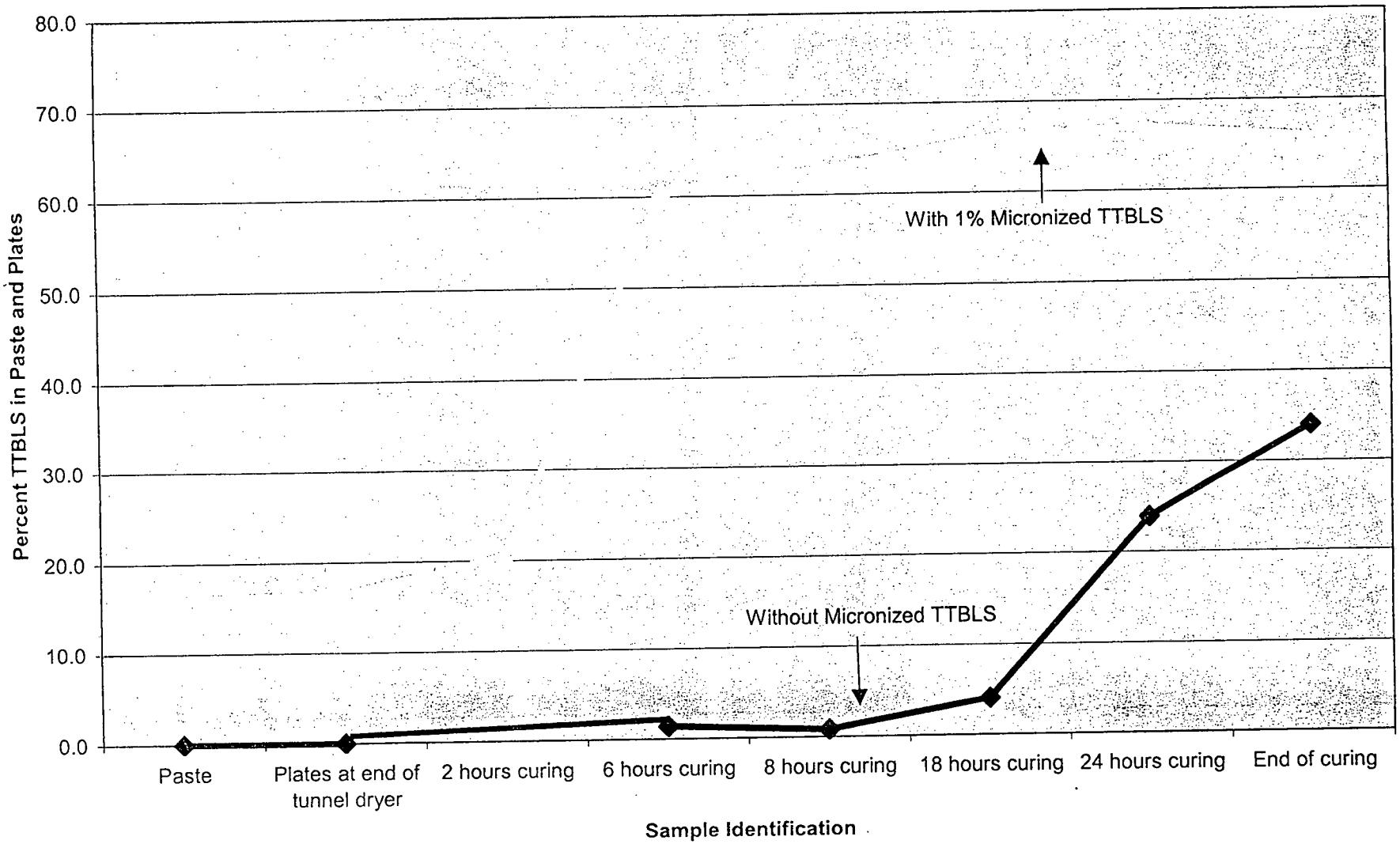


Fig. 8

Control Samples (No Micronized Tetrabasic Lead Sulfate)	Time (hrs.)	Pb	α-PbO (Tetra)	β-PbO (Ortho)	TTBLS	TRBLS
Control End of Tunnel Dryer 0755 9/25	0	7.7	51.1	0	0	41.2
Control End of Tunnel Dryer 0755 9/25	0	6.5	43.4	9.2	0	38.2
Control End of Tunnel Dryer 0755 9/25	0	6	42.2	5.5	0	43.4
Avg.	0	6.73	45.57	4.9	0	40.93
Control Rack in Curing Chamber 0800 9/25	0.08	0.6	46	6	2.1	43.3
Control Rack in Curing Chamber 0800 9/25	0.08	5.1	43.2	8.5	0	43.3
Control Rack in Curing Chamber 0800 9/25	0.08	8.1	43.8	7.6	0	42.4
Avg.	0.08	3.93	44.33	6.03	0.7	43.00
Control 0945 9/25	1.83	3.5	41.4	13.2	2.1	39.8
Control 0945 9/25	1.83	4.3	42.9	12.8	0.8	39.3
Avg.	1.83	4.46	43.11	10.36	1.45	39.55
Control 1100 2.25 hours 9/25	2.25	4.3	42.4	12.2	1	40.1
Control 1100 2.25 hours 9/25	2.25	3.4	45.4	12.4	0	38.7
Avg.	2.25	3.85	43.9	12.3	0.5	39.4
Control 1145 3 hours 9/25	3	5.2	46.9	3.2	1.4	43.2
Control 1245 4 hours 9/25	4	4.1	45.9	6.5	8.6	38
Control 1245 4 hours 9/25	4	4	47.1	1.6	0	47.3
Avg.	4	4.05	46.5	3.55	3.3	42.65
Control 1345 5 hours 9/25	5	8.3	44	4.2	3.4	40.1
Control 1345 5 hours 9/25	5	2.9	52.5	2.9	0	41.7
Avg.	5	5.6	48.25	3.55	1.7	40.9
Control 1445 6 hours 9/25	6	5.8	43	10.9	2.1	38.2
Control 1445 6 hours 9/25	6	5.2	41.8	11.3	3.7	38
Avg.	6	5.5	42.4	11.1	2.9	38.1
Control 1545 7 hours 9/25	7	1.8	51.1	10.2	0	36.8
Control 1930 9/25	10.75	4.3	47.7	5	1.9	41
Control 2330 9/25	14.75	8.2	43.5	2.9	5.4	40.1
Control 0330 9/26	18.75	2.1	52.2	5.5	3.8	36.2
Control 0730 9/26	22.75	3	52.5	7.4	3.3	33.8
Control 1145 9/26	26.75	0	53.8	1.2	3.9	41.2
Control 1145 9/26	26.75	3.4	54.5	1.9	0	40.2
Avg.	26.75	1.7	54.15	1.55	1.95	40.7
Control 1530 9/26	27.5	0	42.4	9.3	8	40.3
Control 1530 9/26	27.5	1.4	41.3	5.7	4.9	46.7
Avg.	27.5	0.7	41.85	7.5	6.45	43.5
Control 2200 9/26	34	0	50.5	0	11.1	38.4
Control 0430 9/27	40.5	3.5	54.3	1.7	4.3	36.3
Control 1025 9/27	46.5	1.9	46.4	3.6	7.5	40.6
Control 1025 9/27	46.5	3.1	34.1	9.2	11.3	42.3

Fig. 9

Experimental Samples, Trial 1 (1% Micronized Tetrabasic Lead Sulfate)	Time (hrs.)	Pb	α-PbO (Tetra)	β-PbO (Ortho)	Tetra	Tri
Exp 1 Paste Mix 0850 9/25	0	0.9	35.1	1.2	46.9	15.8
Exp 1 Paste Mix 0850 9/25	0	0	23.8	2.2	37.2	36.4
Avg.	0	0.45	29.45	1.7	42.05	26.1
Exp 1 Paste Mix2 1115 9/25	0	2.1	0	4.4	61	32.5
Exp 1 Paste Mix2 1115 9/25	0	0	0	5	61.9	33.2
Avg.	0	1.05	0	4.7	61.45	32.85
Exp 1 End of Tunnel Dryer 0910 9/25	0.33	0	31.7	5.3	34.7	28.2
Exp 1 1100 1.25 hours 9/25	1.25	0.4	35.8	3.7	37	23.1
Exp 1 1245 3 hours 9/25	3	2.1	21.8	2.3	60.4	13.5
Exp 1 1245 3 hours 9/25	3	0	21.6	2.6	64.2	11.7
Avg.	3	1.05	21.7	2.45	62.3	12.6
Exp 1 1345 4 hours 9/25	4	0	16	3.4	70.3	10.3
Exp 1 1345 4 hours 9/25	4	1.8	19.1	2.7	68.1	8.3
Exp 1 1345 4 hours 9/26	4	0.7	19.9	2.1	69.4	7.9
Avg.	4	0.83	18.33	2.73	69.27	8.83
Exp 1 1545 6 hours 9/25	6	0	12.9	1.1	80.1	5.9
Exp 1 1545 6 hours 9/25	6	0	8.2	7	72.8	12
Avg.	6	0	10.55	4.05	76.45	8.95
Exp 1 1930 9/25	9.75	0	5.9	10.3	77.7	6.1
Exp 1 1930 9/25	9.75	5.2	12.4	2.1	79.7	0.6
Avg.		2.6	9.15	6.2	78.7	3.35
Exp 1 2330 9/25	13.75	0	16.3	2.3	77.1	4.3
Exp 1 0330 9/26	17.75	0	16.8	1	76.5	2.8
Exp 1 0330 9/26	17.75	2.4	6.8	8.6	77	5.3
Exp 1 0330 9/26	17.75	0	15.7	2.3	77.7	4.3
Avg.	17.75	0.8	13.1	3.97	77.73	4.13
Exp 1 0730 9/26	21.75	1.3	4.6	9.1	78.5	6.4
Exp 1 1145 9/26	25	0.8	7.4	5	79.9	6.8
Exp 1 0430 9/27	29.75	0.5	7.5	0	87.3	4.7
Exp 1 0430 9/27	29.75	0	20.8	2.1	77.3	0
Exp 1 0430 9/27	29.75	0	13.8	2.9	81.8	0
Avg.	29.75	0.17	13.97	1.63	82.13	1.57
Exp 1 1025 9/27	35.75	0	19.5	2.5	78.5	0
Exp 1 1025 9/27	35.75	0	17.4	2.9	79.6	0
Avg.	35.75	0	18.45	2.7	79.05	0

Fig. 10

Experimental Samples, Trial 2 (1% Micronized Lead Sulfate)	Time (hrs.)	Pb	α-PbO (Tetra)	β-PbO (Ortho)	Tetra	Tri
Exp 2 Paste Mix 1010 9/25	0	0	29.2	0.9	58.7	13.1
Exp 2 Paste Mix 1010 9/25	0	1.1	28.7	1.3	53.4	15.5
Exp 2 Paste Mix 1010 9/25	0	0	20.1	1.9	51.6	26.4
Avg.	0	0.37	28.00	1.37	53.90	18.33
Exp 2 End of Tunnel Dryer 1015 9/25	0.2	1.5	33.7	1.6	40	23.2
Exp 2 Rack in Curing Chamber 1030 9/25	0.33	1.6	32.6	3	41.9	20.9
Exp 2 1115 1 hour 9/25	1	1.9	28	1.5	51.5	17.2
Exp 2 1215 2 hours 9/25	2	0	26.8	2.3	60.5	10.4
Exp 2 1215 2 hours 9/25	2	0	26.6	0	62.2	11.2
Avg.	2	0	26.7	1.15	61.35	10.8
Exp 2 1415 4 hours 9/25	4	0	15.3	3.7	78.7	2.4
Exp 2 1415 4 hours 9/25	4	2.9	19.7	2.5	65.8	9.1
Avg.	4	1.45	17.5	3.1	72.25	5.75
Exp 2 1515 5 hours 9/25	5	1.7	15	2.9	80.4	0
Exp 2 1545 5.5 hours 9/25	5.5	1.7	14.8	3.3	75.8	4.4
Exp 2 1615 6 hours 9/25	6	0	14.0	3.1	82.3	0
Exp 2 1615 6 hours 9/25	6	0	15.4	2.3	75.4	6.4
Exp 2 test 4 1615 9/25	6	1.2	17.9	2.3	70.6	7.4
Avg.	6	0.4	15.87	2.93	76.10	4.60
Exp 2 1930 9/25	9.25	0.8	13.9	3.4	77	4.9
Exp 2 2230 9/25	12.25	0	15.1	3.6	81.3	0
Exp 2 0730 9/26	21.75	0	10.7	2.4	81.1	5.2
Exp 2 0730 9/26	21.75	0	6.2	1.6	87.2	5
Avg.	21.75	0	8.45	2	84.15	5.1
Exp 2 1145 9/26	26	0	4	5.8	84.4	5.8
Exp 2 1145 9/26	26	0.8	16.9	2.9	79	0.5
Exp 2 1145 9/26	26	0.5	16.5	3.3	79.7	7
Avg.	26	0.43	12.47	4.00	81.03	4.43
Exp 2 1530 9/26	29.25	0	18.7	1.9	79.5	0
Exp 2 1630 9/26	30.25	0	16.8	2	81	0
Exp 2 2200 9/26	35.75	0	18.2	2.9	78.9	0
Exp 2 2200 9/26	35.75	0.5	18.3	2.2	79	0
Avg.	35.75	0.25	18.25	2.55	78.95	0
Exp 2 1025 9/27	48.17	0	16.5	3.1	80.4	0

Fig. 11 ~~Fig. 8~~

Fourth sample
& Fifth Sample

Effect of 1% micronized TTBLS on Automotive Paste and Plate Curing

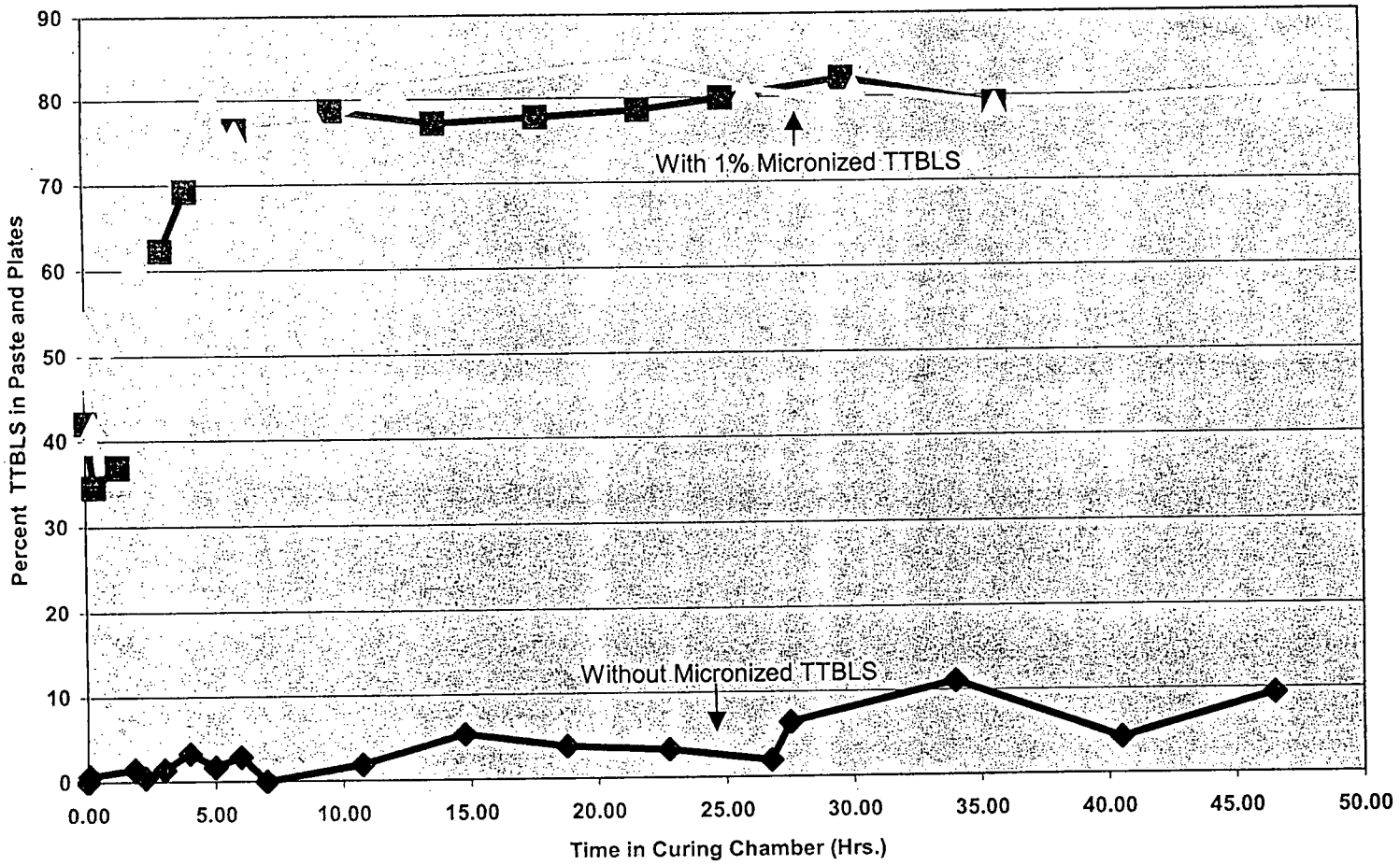
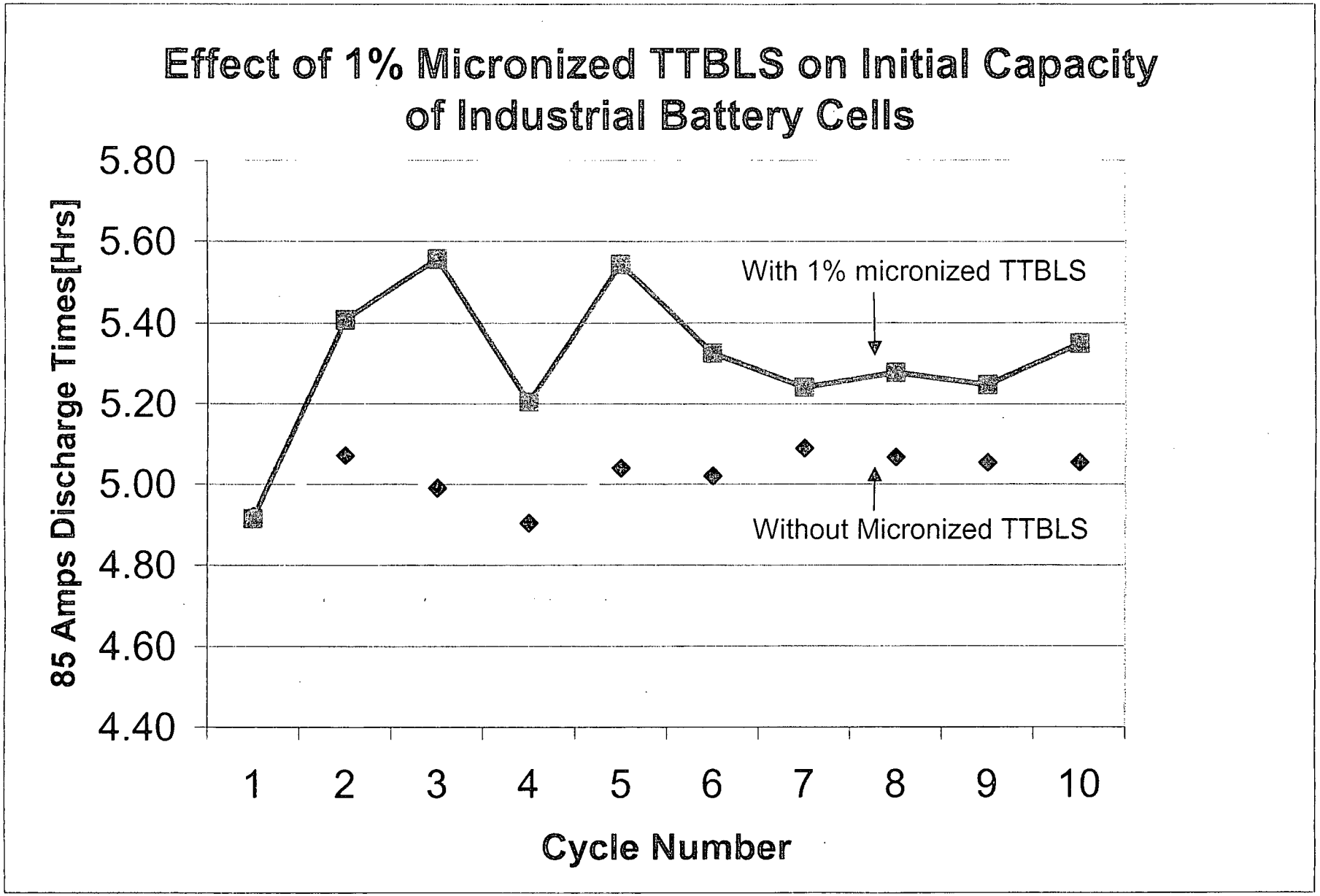


Fig. 9- Fig. 12


Effect of 1% Micronized TTBLS on Initial Capacity of Industrial Battery Cells
85 Amps Discharge Times[Hrs]
5.80
5.60
5.40
5.20
5.00
4.80
4.60
4.40
With 1% micronized TTBLS
Without Micronized TTBLS
1
2
3
4
5
6
7
8
9
10
Cycle Number

~~Fig 10~~

Fig. 13

Data From Fourteen Separate Paste Mixes Containing 1% Micronized TTBLS

Paste Mix No.	Pb [wt. %]	Alpha - PbO [wt. %]	Beta - PbO [wt. %]	Tetrabasic Lead Sulphate [wt. %]	Tribasic Lead Sulphate [wt. %]
Mix - 1	0.0	27.0	1.3	71.7	0.0
Mix - 2	2.8	15.5	0.9	79.4	1.4
Mix - 3	0.0	16.7	1.7	81.6	0.0
Mix - 4	1.7	21.3	1.3	75.7	0.0
Mix - 5	4.6	23.1	1.6	70.8	0.0
Mix - 6	0.0	29.0	1.1	69.9	0.0
Mix - 7	1.1	25.8	1.7	71.4	0.0
Mix - 8	1.6	25.2	0.8	72.5	0.0
Mix - 9	1.5	29.9	1.1	67.5	0.0
Mix - 10	5.7	28.5	0.8	65.1	0.0
Mix - 11	2.2	30.0	1.7	60.5	5.7
Mix - 12	1.3	27.0	1.7	69.9	0.0
Mix - 13	0.0	25.5	2.5	71.9	0.0
Mix - 14	0.0	26.3	1.8	71.9	0.0

Fig. 11 Fig. 14

Without Micronized TTBLS	1st Reserve Capacity Minutes	2nd Reserve Capacity Minutes	3rd Reserve Capacity Minutes	1st Cold Cranking Amps Amperes	2nd Cold Cranking Amps Amperes	3rd Cold Cranking Amps Amperes	Ampere-hours at 20 Hour Rate
	125.9	114.8	94.9	699	713	676	57.9
	124.6	116.9	99.6	702	723	676	59.2
	123.7	112.4	94.7	693	710	660	57
Avg.	124.7	114.7	96.4	698	715	671	58.02
With Micronized TTBLS	126.7	132	126.7	705	748	666	64.7
	127.3	130.5	124.2	705	742	675	63.3
	128.1	131.1	126.7	701	732	685	63.78
Avg.	127.4	131.2	125.8	704	740	675	63.92